

CLAIMS

1. An audio user-interfacing method in which each of a plurality of items is represented in
5 an audio field by at least one respective synthesized sound source from where sounds
related to the item appear to emanate, the method comprising the steps of:
 - (a) determining, for each said sound source, an associated rendering position at which the
sound source is to be synthesized to sound in the audio field, the rendering positions
associated with the sound sources being distributed over an at least part-cylindrical
10 notional surface; and
 - (b) generating, using audio output devices, an audio field in which said sound sources are
synthesized at their associated rendering positions to provide sounds related to the
items concerned.
- 15 2. A method according to claim 1, including the further step of displacing the audio field
in a direction parallel to the axis of said at least part-cylindrical surface whereby to change
the portion of the field closest to a reference position where a user is at least notionally
located.
- 20 3. A method according to claim 2, including the further step of rotating the audio field
about the axis of said at least part-cylindrical surface.
4. A method according to claim 2, in which the audio field is displaced in said direction in
discrete steps of predetermined magnitude.
- 25 5. A method according to claim 4, wherein the axis of said at least part-cylindrical surface
is vertically disposed, the sound sources being notionally grouped at differing levels
corresponding to floors of a building, the predetermined magnitude of said discrete steps
corresponding to moving up or down one floor.
- 30 6. A method according to claim 4, wherein the sound sources are arranged in groups with
the sound sources in each group being at the same position along said axis and the groups

being separated one from another along said axis by distances corresponding to multiples, including one, of said predetermined magnitude.

7. A method according to claim 2, wherein sound sources located in the audio field outside
5 of a focus zone fixed relative to said reference position, are at least partially muted relative to sound sources inside the focus zone; the sound sources being un-muted and muted as they move into and out of the focus zone in response to displacement of the audio field in said direction parallel to the axis of the at least part-cylindrical surface.

10 8. A method according to claim 7, wherein sound sources adjacent to, but outside of, the focus zone are partially muted whilst those further from the focus zone are fully muted.

9. A method according to claim 7, wherein sound sources outside of the focus zone are fully muted, an audio indication of the sound sources existing beyond the focus zone in at
15 least one direction being provided un-muted in the audio field.

10. A method according to claim 1, wherein the audio field is stabilised relative to one of:

- a user's head;
- a user's body;
- 20 - a vehicle in which the user is travelling;
- the world;

this stabilisation taking account of whether the audio output devices are world, vehicle, body or head mounted, and, as appropriate, rotation of the user's head or body, or of the vehicle, about an axis parallel to the said axis of the at least part-cylindrical surface.

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11. A method according to claim 1, wherein further sound sources are synthesized to lie at different radial distances from the axis of said at least part-cylindrical surface to the sound sources distributed over that surface.

30 12. A method according to claim 1, wherein the axis of said at least part-cylindrical surface is vertically disposed.

13. A method according to claim 1, wherein the axis of said at least part-cylindrical surface is horizontally disposed.

14. A method according to claim 1, wherein at least some of the said items represented by
5 the sound sources are audio labels for services, the method further involving selecting a service by selecting the corresponding audio-label sound source.

15. An audio user-interfacing method in which each of a plurality of items is represented in an audio field by at least one respective synthesized sound source from where sounds
10 related to the item appear to emanate, the method comprising the steps of:

- (a) determining, for each said sound source, an associated rendering position at which the sound source is to be synthesized to sound in the audio field;
 - (b) generating, using audio output devices, an audio field in which said sound sources are synthesized at their associated rendering positions to provide sounds related to the
15 items concerned;
 - (c) exploring the audio field by rotating it about a predetermined axis; and
 - (d) exploring the audio by displacing it in a direction parallel to said axis;
- with steps (c) and (d) being effected in any order or together.

20 16. A method according to claim 15, in which in step (d) the audio field is displaced in said direction in discrete steps of predetermined magnitude.

17. A method according to claim 16, wherein said axis is vertically disposed, the sound sources being notionally grouped at differing levels corresponding to floors of a building,
25 the predetermined magnitude of said discrete steps corresponding to moving up or down one floor.

18. A method according to claim 17, wherein the sound sources are arranged in groups with the sound sources in each group being at the same position along said axis and the
30 groups being separated one from another along said axis by distances corresponding to multiples, including one, of said predetermined magnitude.

19. A method according to claim 15, wherein sound sources located in the audio field outside of a focus zone fixed relative to a notional user position, are at least partially muted relative to sound sources inside the focus zone; the sound sources being un-muted and muted as they move into and out of the focus zone in response to displacement of the audio field in said direction parallel to the axis of the at least part-cylindrical surface.

20. A method according to claim 19, wherein sound sources adjacent to, but outside of, the focus zone are partially muted whilst those further from the focus zone are fully muted.

21. A method according to claim 19, wherein sound sources outside of the focus zone are fully muted, an audio indication of the sound sources existing beyond the focus zone in at least one direction along said axis being provided un-muted in the audio field.

22. A method according to claim 15, wherein the audio field is stabilised relative to one of:

- a user's head;
- a user's body;
- a vehicle in which the user is travelling;
- the world;

this stabilisation taking account of whether the audio output devices are world, vehicle, body or head mounted, and, as appropriate, rotation of the user's head or body, or of the vehicle, about an axis parallel to the said axis of the at least part-cylindrical surface.

23. A method according to claim 15, wherein the sound sources are distributed over an at least part-cylindrical notional surface.

24. A method according to claim 15, wherein the sound sources are distributed in three dimensions in terms of a cylindrical coordinate system referenced to said axis.

25. A method according to claim 15, wherein said axis is vertically disposed.

26. A method according to claim 15, wherein said axis is horizontally disposed.

27. A method according to claim 15, wherein at least some of the said items represented by the sound sources are audio labels for services, the method further involving selecting a service by selecting the corresponding audio-label sound source.

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28. Apparatus for providing an audio user interface in which each of a plurality of items is represented in an audio field by at least one respective synthesized sound source from where sounds related to the item appear to emanate, the apparatus comprising:

- rendering-position determining means for determining, for each said sound source, an associated rendering position at which the sound source is to be synthesized to sound in the audio field, the rendering positions associated with the sound sources being distributed over an at least part-cylindrical notional surface; and
- rendering means, including audio output devices, for generating an audio field in which said sound sources are synthesized at their associated rendering positions to provide sounds related to the items concerned.

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29. Apparatus according to claim 28, wherein the rendering-position determining means comprises:

- means for setting the location of each said sound source relative to an audio-field reference;
- offset means for controlling an offset between the audio-field reference and a presentation reference determined by a mounting configuration of the audio output devices, the offset means including user input means and being operative to enable a user to set a displacement of the audio field relative to the presentation reference in a direction parallel to the axis of said at least part-cylindrical surface; and
- means for deriving the rendering position of each sound source based on the location of the sound source in the audio field and said offset.

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30. Apparatus according to claim 29, wherein the offset means is further operative to enable a user to set a rotation of the audio field about the axis of said at least part-cylindrical surface.

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31. Apparatus according to claim 29, wherein the offset means is arranged to permit the audio field to be displaced in said direction only in discrete steps of predetermined magnitude.

5 32. Apparatus according to claim 29, further comprising a muting filter operative to at least partially mute sound sources with rendering positions located in the audio field outside of a focus zone fixed relative to said presentation reference.

10 33. Apparatus according to claim 32, wherein the muting filter is operative to only partially mute sound sources adjacent to, but outside of, the focus zone but to fully mute sound sources further from the focus zone.

15 34. Apparatus according to claim 32, wherein the muting filter is operative to fully mute sound sources outside of the focus zone, the apparatus including means for providing an un-muted audio indication of the sound sources existing beyond the focus zone in at least one direction along said axis.

20 35. Apparatus according to claim 28, wherein at least some of the said items represented by the sound sources are audio labels for services, the apparatus including a selection arrangement for selecting a service by selecting the corresponding audio-label sound source.

25 36. Apparatus according to claim 29, wherein the offset means further includes stabilisation means for varying the said offset such as to stabilise the audio field reference relative to one of:

- a user's head;
- a user's body;
- a vehicle mounting the apparatus;
- the world.

37. Apparatus for providing an audio user interface in which each of a plurality of items is represented in an audio field by at least one respective synthesized sound source from where sounds related to the item appear to emanate, the apparatus comprising:

- rendering-position determining means for determining, for each said sound source, an associated rendering position at which the sound source is to be synthesized to sound in the audio field, the rendering-position determining means comprising:
 - means for setting the location of each said sound source relative to an audio-field reference;
 - offset means for controlling an offset between the audio-field reference and a presentation reference determined by a mounting configuration of the audio output devices, the offset means including user input means and being operative to enable a user both:
 - to set a rotation of the audio field about a predetermined axis, and
 - to set a displacement of the audio field relative to the presentation reference in a direction parallel to said axis; and
 - means for deriving the rendering position of each sound source based on the location of the sound source in the audio field and said offset; and
- rendering means, including audio output devices, for generating an audio field in which said sound sources are synthesized at their associated rendering positions to provide sounds related to the items concerned.

38. Apparatus according to claim 37, wherein the offset means is arranged to permit the audio field to be displaced in said direction only in discrete steps of predetermined magnitude.

39. Apparatus according to claim 37, further comprising a muting filter operative to at least partially mute sound sources with rendering positions located in the audio field outside of a focus zone fixed relative to said presentation reference.

40. Apparatus according to claim 39, wherein the muting filter is operative to only partially mute sound sources adjacent to, but outside of, the focus zone but to fully mute sound sources further from the focus zone.

41. Apparatus according to claim 39, wherein the muting filter is operative to fully mute sound sources outside of the focus zone, the apparatus including means for providing an un-muted audio indication of the sound sources existing beyond the focus zone in at least one direction along said axis.

42. Apparatus according to claim 37, wherein the rendering-position determining means is operative to cause said sound sources to be distributed over an at least part-cylindrical notional surface.

43. Apparatus according to claim 37, wherein the rendering-position determining means is operative to cause the sound sources to be distributed in three dimensions in terms of a cylindrical coordinate system referenced to said axis.

44. Apparatus according to claim 37, wherein at least some of the said items represented by the sound sources are audio labels for services, the apparatus including a selection arrangement for selecting a service by selecting the corresponding audio-label sound source.

45. Apparatus according to claim 37, wherein the offset means further includes stabilisation means for varying the said offset such as to stabilise the audio field reference relative to one of:

- a user's head;
- a user's body;
- a vehicle mounting the apparatus;
- the world.

46. Apparatus for providing an audio user interface in which each of a plurality of items is represented in an audio field by at least one respective synthesized sound source from where sounds related to the item appear to emanate, the apparatus comprising:

- a rendering-position determining arrangement operative to determine, for each said sound source, an associated rendering position at which the sound source is to be

synthesized to sound in the audio field, the rendering positions associated with the sound sources being distributed over an at least part-cylindrical notional surface; and

- a rendering subsystem, including audio output devices, arranged to generate an audio field in which said sound sources are synthesized at their associated rendering positions to provide sounds related to the items concerned.

47. Apparatus according to claim 46, wherein the rendering-position determining arrangement comprises:

- a setting arrangement for setting the location of each said sound source relative to an audio-field reference;
- a control arrangement for controlling an offset between the audio-field reference and a presentation reference determined by a mounting configuration of the audio output devices, the control arrangement including a user input arrangement and being operative to enable a user to set a displacement of the audio field relative to the presentation reference in a direction parallel to the axis of said at least part-cylindrical surface; and
- a deriving arrangement operative to derive the rendering position of each sound source based on the location of the sound source in the audio field and said offset.

48. Apparatus according to claim 47, wherein the control arrangement is further operative to enable a user to set a rotation of the audio field about the axis of said at least part-cylindrical surface.

49. Apparatus according to claim 47, wherein the control arrangement is arranged to permit the audio field to be displaced in said direction only in discrete steps of predetermined magnitude.

50. Apparatus according to claim 47, further comprising a muting filter operative to at least partially mute sound sources with rendering positions located in the audio field outside of a focus zone fixed relative to said presentation reference.

51. Apparatus according to claim 50, wherein the muting filter is operative to only partially mute sound sources adjacent to, but outside of, the focus zone but to fully mute sound sources further from the focus zone.

5 **52.** Apparatus according to claim 50, wherein the muting filter is operative to fully mute sound sources outside of the focus zone, the apparatus including means for providing an un-muted audio indication of the sound sources existing beyond the focus zone in at least one direction along said axis.

10 **53.** Apparatus according to claim 46, wherein at least some of the said items represented by the sound sources are audio labels for services, the apparatus including a selection arrangement for selecting a service by selecting the corresponding audio-label sound source.

15 **54.** Apparatus according to claim 47, wherein the offset means further includes stabilisation means for varying the said offset such as to stabilise the audio field reference relative to one of:

- a user's head;
- a user's body;

20 - a vehicle mounting the apparatus;

- the world.

55. Apparatus for providing an audio user interface in which each of a plurality of items is represented in an audio field by at least one respective synthesized sound source from
25 where sounds related to the item appear to emanate, the apparatus comprising:

- a rendering-position determining arrangement operative to determine, for each said sound source, an associated rendering position at which the sound source is to be synthesized to sound in the audio field, the rendering-position determining means comprising:

30 - a setting arrangement for setting the location of each said sound source relative to an audio-field reference;

- a control arrangement for controlling an offset between the audio-field

reference and a presentation reference determined by a mounting configuration of the audio output devices, the control arrangement including a user input device and being operative to enable a user both:

- to set a rotation of the audio field about a predetermined axis, and
- 5 - to set a displacement of the audio field relative to the presentation reference in a direction parallel to said axis; and
- a deriving arrangement for deriving the rendering position of each sound source based on the location of the sound source in the audio field and said offset; and
- a rendering subsystem, including audio output devices, operative to generate an audio
- 10 field in which said sound sources are synthesized at their associated rendering positions to provide sounds related to the items concerned.

56. Apparatus according to claim 55, wherein the control arrangement is operative to permit the audio field to be displaced in said direction only in discrete steps of

15 predetermined magnitude.

57. Apparatus according to claim 55, further comprising a muting filter operative to at least partially mute sound sources with rendering positions located in the audio field outside of a focus zone fixed relative to said presentation reference.

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58. Apparatus according to claim 57, wherein the muting filter is operative to only partially mute sound sources adjacent to, but outside of, the focus zone but to fully mute sound sources further from the focus zone.

25 59. Apparatus according to claim 57, wherein the muting filter is operative to fully mute sound sources outside of the focus zone, the apparatus including an arrangement operative to provide an un-muted audio indication of the sound sources existing beyond the focus zone in at least one direction along said axis.

30 60. Apparatus according to claim 55, wherein the rendering-position determining arrangement is operative to cause said sound sources to be distributed over an at least part-cylindrical notional surface.

61. Apparatus according to claim 55, wherein the rendering-position determining arrangement is operative to cause the sound sources to be distributed in three dimensions in terms of a cylindrical coordinate system referenced to said axis.

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62. Apparatus according to claim 55, wherein at least some of the said items represented by the sound sources are audio labels for services, the apparatus including a selection arrangement for selecting a service by selecting the corresponding audio-label sound source.

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63. Apparatus according to claim 55, wherein the control arrangement further includes stabilisation means for varying the said offset such as to stabilise the audio field reference relative to one of:

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- a user's head;
- a user's body;
- a vehicle mounting the apparatus;
- the world.